Photovoltaic energy monitoring datalogger

PV-Monitor, PV-Monitor-M

INSTRUCTION MANUAL

(M135B01-03-17A)
SAFETY PRECAUTIONS

Follow the warnings described in this manual with the symbols shown below.

**DANGER**
Warns of a risk, which could result in personal injury or material damage.

**ATTENTION**
Indicates that special attention should be paid to a specific point.

If you must handle the unit for its installation, start-up or maintenance, the following should be taken into consideration:

Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire.

Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.

Refer to the instruction manual before using the unit
In this manual, if the instructions marked with this symbol are not respected or carried out correctly, it can result in injury or damage to the unit and/or installations.

CIRCUTOR, SA reserves the right to modify features or the product manual without prior notification.

DISCLAIMER

CIRCUTOR, SA reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

CIRCUTOR, SA on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

www.circutor.com
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### REVISION LOG

Table 1: Revision log.

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/16</td>
<td>M135B01-03-16A</td>
<td>Initial Version</td>
</tr>
<tr>
<td>01/17</td>
<td>M135B01-03-17A</td>
<td>Changes in the following sections:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.- 6.1.- 6.1.1.- 6.1.3.- 6.1.4 - 6.2.- 6.3.</td>
</tr>
</tbody>
</table>

**Note:** Images of the devices are for illustrative purposes only and may differ from the actual device.
1.- VERIFICATION UPON RECEPTION

Check the following points when you receive the device:

a) The device meets the specifications described in your order.
b) The device has not suffered any damage during transport.
c) Perform an external visual inspection of the device prior to switching it on.
d) Check that it has been delivered with the following:
   - A router.

If any problem is noticed upon reception, immediately contact the transport company and/or CIRCUTOR’s after-sales service.

2.- INTRODUCTION

The PV-Monitor is an energy manager that has been designed to monitor instantaneous self-consumption photovoltaic energy installations (with or without injection into the grid). It features a datalogger and web server with PowerStudio Embedded and a SCADA application for this purpose. This device provides real-time information about the photovoltaic energy production levels, energy savings and the consumption of a building, home, office, etc., as well as storing historical data to perform periodic analyses.

The SCADA electric energy management application can provide real-time information about the photovoltaic energy production levels, electricity savings and the load consumption of electricity of a building, home, office, etc. It receives the internal variables of a CDP-0 and does not depend on the configuration of the photovoltaic energy plant (installed power, inverter device, single or three-phase network and measuring points).

This device has 2 models:

- PV-Monitor.
- PV-Monitor-M.
The device features:

- An Ethernet Port.
- Indicator LEDs.
- Display with two 20-character rows.
- 4 keys

The **PV-Monitor** model also features:

- RS-485 Communications.
- 1 surface temperature sensor (photovoltaic modules),
- 1 solar radiation sensor,
- 1 ambient temperature sensor.

These accessories can be used to calculate the installation's efficiency.

The **PV-Monitor** requires the use of the following devices to achieve the correct electric energy management of an installation:

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E51001</td>
<td>CDP-0</td>
<td>Dynamic power controller</td>
</tr>
<tr>
<td>EX056</td>
<td>RT-N150</td>
<td>Router (Supplied with the <strong>PV-Monitor</strong> device)</td>
</tr>
</tbody>
</table>

The **PV-Monitor-M** model requires the use of the following devices:

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E51001</td>
<td>CDP-0</td>
<td>Dynamic power controller</td>
</tr>
<tr>
<td>EX056</td>
<td>RT-N150</td>
<td>Router (Supplied with the <strong>PV-Monitor-M</strong> device)</td>
</tr>
<tr>
<td>E80002</td>
<td>TR16-RS485</td>
<td>Multi-channel DC voltage and current analyzer for photovoltaic strings</td>
</tr>
<tr>
<td>M40180</td>
<td>PSC-120-24</td>
<td>Power supply for TR16-RS485 (120 Vac / 24 Vdc)</td>
</tr>
<tr>
<td>M80010</td>
<td>M/TR-25 x2</td>
<td>Measuring module for 2 current circuits</td>
</tr>
<tr>
<td>M80011</td>
<td>M/TR-25 x4</td>
<td>Measuring module for 4 current circuits</td>
</tr>
<tr>
<td>M61310</td>
<td>TH-DG-RS485</td>
<td>Ambient temperature sensor</td>
</tr>
<tr>
<td>EX0036</td>
<td>STS</td>
<td>Temperature sensor for photovoltaic panels</td>
</tr>
<tr>
<td>EX0033</td>
<td>SRS</td>
<td>Solar radiation sensor</td>
</tr>
</tbody>
</table>

The functional features of the **SCADA** application are:

- Display of the parameters measured and/or calculated by the devices in real time on the **SCADA** screens
- Setup of general system alarms to warn about the anomalous operation of a photovoltaic energy installation.
3.- INSTALLATION OF THE DEVICE

3.1.- PREVIOUS RECOMMENDATIONS

In order to use the device safely, it is critical that individuals who handle it follow the safety measures set out in the standards of the country where it is being used, use the personal protective equipment necessary, and pay attention to the various warnings indicated in this instruction manual.

The **PV-Monitor** device must be installed by authorised and qualified staff.

The power supply plug must be disconnected and measuring systems switched off before handling, altering the connections or replacing the device. It is dangerous to handle the device while it is powered.

Also, it is essential to keep the cables in perfect condition to avoid accidents, personal injury and damage to installations.

The manufacturer of the device is not responsible for any damage resulting from failure by the user or installer to observe the warnings and/or recommendations set out in this manual, nor for damage resulting from the use of non-original products or accessories or those made by other manufacturers.

If an anomaly or malfunction is detected in the device, do not use the device to take any measurements.

Inspect the work area before taking any measurements. Do not take measurements in dangerous areas or where there is a risk of explosion.

Disconnect the device from the power supply (device and measuring system power supply) before maintaining, repairing or handling the device’s connections. Please contact the after-sales service if you suspect that there is an operational fault in the device.
3.2.- INSTALLATION

The **PV-Monitor** has been designed for mounting on a DIN rail, with standard fixing points so that it can be mounted on the rail.

![Warning icon]

Terminals, opening roofs or removing elements can expose parts that are hazardous to the touch while the device is powered. Do not use the device until it is fully installed.

3.3.- DEVICE TERMINALS

3.3.1. PV-Monitor

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Table 4: List of terminals of the PV-Monitor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Ethernet, Ethernet connection</td>
<td>3: N, Auxiliary power supply</td>
</tr>
<tr>
<td>2: L, Auxiliary power supply</td>
<td>4: Ground connection</td>
</tr>
</tbody>
</table>

![Small drawing of the PV-Monitor terminals]
### 3.3.2. PV-Monitor-M

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Ethernet, Ethernet connection</td>
<td>5: L, Auxiliary power supply</td>
</tr>
<tr>
<td>2: A, RS-485 connection</td>
<td>6: N, Auxiliary power supply</td>
</tr>
<tr>
<td>3: S, RS-485 connection</td>
<td>7: Ground connection</td>
</tr>
<tr>
<td>4: B, RS-485 connection</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2:** PV-Monitor-M terminals.
3.4.- CONNECTION DIAGRAMS

3.4.1. PV-Monitor

Figure 3: Connection diagram of the PV-Monitor system.
3.4.2. PV-Monitor-M

Figure 4: Connection diagram of the PV-Monitor-M system.
4.1.- LED INDICATORS

The **PV-Monitor** features 2 indicator LEDs:

- **CPU**
  - **Blinking light:** Indicates that the device is operating correctly.
  - **Power on:** The device is not functioning properly.

- **SLAVE**
  - **Off:** All connected devices are communicating correctly.
  - **Power on:** One or more devices are not communicating.

4.2.- DISPLAY

The device features a backlit LCD display that can be used to configure the network parameters.
The main screen of the display shows the date and time of the device.

![Main screen of the PV-Monitor](image)

4.3.- KEYS

The **PV-Monitor** features 4 keys, **Figure 5**, to configure the network parameters.
5.- START-UP

Follow these steps to start-up the **PV-Monitor**: 

5.1.- STEP 1: HARDWARE INSTALLATION

Install all system devices. Follow the instructions of the installation manual of each device and the connection diagram in section “**3.4.- CONNECTION DIAGRAMS**”

A.- PV-Monitor System

A **PV-Monitor** system is composed of the following elements:

- ✓ Dynamic power controller, **CDP-0**.
- ✓ **PV-MONITOR**
- ✓ **Router**, to create the internal communications network.

![Router customer](image)

![Figure 7: PV-Monitor System.](image)

B.- PV-Monitor-M System

The **PV-Monitor-M** system is composed of the following elements:

- ✓ Dynamic power controller, **CDP-0**.
- ✓ **PV-Monitor-M**
- ✓ **Router**, to create the internal communications network.
- ✓ **TR-16**, multi-channel DC voltage and current analyzer.
- ✓ Temperature and Solar radiation sensors.
- ✓ **M/TR-25**, measurement module for current circuits.
5.2.- STEP 2: CONFIGURATION OF THE CDP-0

Configure the network parameters of the **CDP-0**, so it can communicate with the **PV-Monitor**:

- **IP**: *192.168.0.3*
- **MASK**: *255.255.255.0*
- **Gateway (GW)**: *192.168.0.1*

Follow the steps in the instruction manual of the **CDP-0** (*M98250001-01-xxx*), section **“5.2. NETWORK MENU”**.

Check that the **CDP-0** has been correctly installed with the validation of its measuring points (PV energy generation, consumption and network). In the event of anomalies, report the results of the inspection to the end customer / installer.
5.3.- STEP 3: CONFIGURATION OF THE PV-Monitor

Follow these steps to configure the network parameters of the PV-Monitor:

1.- Press the ► + ▲ + ▼ keys simultaneously for more than two seconds. A warning message is displayed.

*Note:* After entering the setup menu, if no key is pressed for 30 seconds, the device will exit the setup menu. If any change has been made to the setup, it will not be applied unless the last menu option is accessed (save changes).

2.- Press the ▼ arrow twice. The DHCP option will be set to YES. Using the ◄ or ► keys, the configuration can be changed to YES or NO. Leave this parameter set to NO.

3.- Press the ▼ key twice to access the configuration of the IP address.

4.- Press the ► key once to activate the edit mode. A cursor will appear under the first digit of the IP address.

   Press the ▲ or ▼ keys to increase or decrease the value of the digit being edited.

   Press the ◄ or ► key to move the edit cursor horizontally and select the next or previous digit to be edited.

   Repeat the steps to complete the IP address: 192.168.0.2.

5.- With the IP address complete and the edit cursor on the last digit, press the ► key; the cursor will disappear.

6.- Press the ▼ key to move to the next parameter to be configured, the subnet mask or NET-MASK.

   Press the ► key to increase the subnet mask blocks.

   Mask: 255.255.255.0,

7.- Press the ▼ key to move to the next parameter to be configured, the Gateway.

   Gateway: 192.168.0.1

   Use the ▲, ▼ and ► keys to modify the value.

5.4.- STEP 4: CONFIGURATION OF THE ROUTER

Configure the network parameters of the router supplied with the device. To do so:

1.- Connect an Ethernet cable between the Client router and router of the installation (yellow RJ45).

2.- Connect an Ethernet cable between the computer and router of the installation.

3.- Connect an Ethernet cable between the PV-Monitor and router of the installation.

4.- Connect an Ethernet cable between the CDP-0 and router of the installation.
5.- Access the router of the installation, IP: 192.168.0.1.
A screen will be displayed, where you must enter the access password:

   User: **Admin**,  
   Password: leave blank,

**Note:** Check that the **CDP** and **PV-Monitor** are in the same IP range.

6.- In the main screen of the router, Figure 10, select **Advanced network parameters**.

![Figure 9: Connections of the router of the installation.](image)

![Figure 10: Main screen of the router.](image)
7.- Enter the **Advanced** menu and, in the **Port Forwarding rules** section, route the **PV-Monitor** and **CDP-0** as indicated in Figure 11.

![Figure 11: Router configuration screen](image)

8.- Save the router configuration.

9.- Remove the Ethernet cable connected between the computer and the router.

10.- Open a browser in a computer connected to the network of the **PV-Monitor** and **CDP-0** and enter:

   - **http://IP_ROUTER:8080/html5/index.html** to access the web server of the **PV-Monitor**
   - **http://IP_ROUTER:8081** to access the web server of the **CDP-0**
   - **http://IP_ROUTER:8081/setup** to access the configuration web server of the **CDP**

   Where **IP_ROUTER** is the external IP address of the router, as shown in Figure 10.

5.5.- **STEP 5: (PV-Monitor-M MODEL) CONFIGURATION OF THE RS-485 BUS**

The **PV-Monitor-M** model communicates with the **TR16** and with the **Ambient temperature sensor** via the RS-485 bus.

The following must be configured for both devices to communicate:

**A.- TR16**

- Peripheral number: 2
- Transmission speed: **9600 bauds**
- Position of the 4 dips: **off (down)**

**B.- Ambient temperature sensor**

The parameters of the probe have already been configured, so its installation is plug&play. You only need to power the probe and connect the RS-485 bus.

**Note:** **Please refer to the instruction manuals if you have any doubts in relation to the configuration of the devices.**
5.6.- STEP 6: CONFIGURATION OF THE INSTALLATION PARAMETERS

Access the PV_Monitor application and configure:

✓ the parameters of the PV installation, see “6.2.- SETUP SCREEN”.

✓ the alarm parameters, see “6.4.- CONFIGURATION OF THE ALARMS”.
The **PV-Monitor** and **PV-Monitor-M** applications can:

- Monitor and control all devices in the installation in real time.
- Calculate the instantaneous energy balance of consumption compared to PV energy generation.
- Calculate the % self-consumption of the current month (solar fraction).
- Configure the monthly PV energy production targets.
- Configure alarms to warn about anomalous operation:
  - Device communication errors,
  - Detection of reverse current,
  - Modulation of the inverter power,
  - Low solar fraction.
- Receive alarm warnings via e-mail.

### 6.1.- MAIN SCREEN

**Figure 12** and **Figure 13** show the main screens of the SCADA **PV-Monitor** and **PV-Monitor-M** application. These screens are used as the control panel to monitor and control the photovoltaic energy installation, providing all useful information required to guarantee its top performance.
The screen is divided into two areas, Figure 13:

- **Top area**, where you can:
  - Modify the screen resolution, according to the device used to view the parameters.
  - Access the setup screen (See “6.2.- SETUP SCREEN”).
  - **PV-Monitor-M** Model: Access the String monitoring screen (See “6.3.- STRING MONITORING SCREEN”).

- **Central area**, which displays all general data of the installation.
6.1.1. ENERGY BALANCE

The Energy balance widget displays all general data of the installation, Figure 15

The **Grid** section shows:

✓ The *instantaneous network consumption*, in kW.
✓ The *network consumption of the current month*, in kWh.

The **PV Generatos** section shows:

✓ The *target PV production of the current month*, in kWh.
✓ The *installed PV power*, in kWp.
✓ The *instantaneous PV production*, in kW.
✓ The *PV production of the current month*, in kWh.
✓ The graphical representation of the degree of completion of the *target PV production*.
✓ *When you click on the left mouse button*: The daily graphical representation of the *PV production, network consumption* and *building consumption values*, Figure 16.
The following is displayed in the **Building consumption** section:

- The **instantaneous consumption**, in kW.
- The **consumption of the current month**, in kWh.
- The graphical representation of the **% instantaneous network consumption** and of the **instantaneous PV energy production**.
- *When you click on the left mouse button:* The monthly graphical representation of the **PV production**, **network consumption** and **building consumption** values. The evolution of the **Solar Fraction as a %** throughout the month as compared to the annual average target is also shown, **Figure 17**.

![Figure 16: Daily graphical representation of the PV production, network consumption and building consumption (kW).](image)

![Figure 17: Monthly graphical representation of the PV production, network consumption and building consumption (kWh).](image)
6.1.2. SOLAR FRACTION

The solar fraction of a photovoltaic energy installation is the ratio between the self-consumed solar energy and the total energy required for a specific application.

\[
\text{Solar fraction} = \frac{\text{PV Production (kWh)}}{\text{Consumption (kWh)}}
\]

Figure 18:Solar fraction widget.

An alarm based on the estimated annual average solar fraction has been programmed to help the user diagnose a low solar fraction (an economic analysis is required for this estimate).

In the example shown in Figure 18, the alarm has not been activated and this indicates that the solar fraction of the current month (25%) exceeds the estimated annual average target (20%).

6.1.3. ALARMS

This widget shows the alarms that affect the performance of the PV energy installation to help the user diagnose the anomalous operation of their PV energy installation.

Figure 19:Alarms widget.

The alarms are grouped into 3 categories:

- Inverter alarms: reverse current detection
- PV generator production alarms (CDP modulation)
- DC Imbalance A string alarm
An alarm is also used to indicate the loss of communication between units, Figure 20. In the case of the **PV-Monitor-M**, the alarm will be activated when communication is lost with the **CDP**, the ambient temperature sensor or the **TR-16**. In the case of the **PV-Monitor**, only the loss of communication with the **CDP** device will be indicated.

![Communications alarm](Figure 20:Communications alarm.)

The **PV-Monitor-M** model also displays an alarm when the performance rate of the inverter is low (the solar fraction). This alarm is sent when the real production conditions are far from the theoretical values that have been calculated.

![Performance ratio & alarms](PERFORMANCE RATIO & ALARMS)

Active alarms are displayed in red.

### 6.1.4. MONTHLY RESUME

The Indicators widget, Figure 22, shows:

- The **PV production of the current month**, in kWh.
- The **savings achieved during the current month**, in €
- The **kg of equivalent CO₂**

![Monthly resume - January](MONTHLY RESUME - JANUARY)

![Indicators widget](Figure 22:Indicators widget.)
The PV-Monitor-M model also displays the temperature and radiation data of the installation:

- The solar irradiance.
- The Ambient temperature, Tamb.
- The Temperature of the modules, Tmod.

![Radiation and temperature indicator widget (PV-Monitor-M).](image)

6.2.- SETUP SCREEN

The screen shown in Figure 24 is the PV energy installation parameter setup screen.

![Setup screen.](image)

To modify a value, scroll over it and left-click on it. The edit screen shown in Figure 25 will be displayed.
You can configure the following parameters on this screen:

**PV Power Capacity:**
The installed PV power of the installation, in kWp.

**Objective - Solar fraction:**
The average monthly target of the solar fraction, for the activation or deactivation of the low solar fraction alarm.

**Monthly energy closure:**
You can configure the following parameters in this section:

- **kWh / Month 1st**, the production and consumption values of the last month are recorded in this section.

- **Month closure setp oint**, the production and consumption parameters are set in this section.

**Objective - Monthly PV production:**
The monthly PV energy production targets are set in this section.

**Tariff price:**
You can configure the following parameters in this section:

- **Currency**, the currency of the country where the PV energy installation is located.
- **Energy Price**, the price of energy self-consumed from a renewable source of energy (PV) in €/kWh.
- **Tax 1, Tax 2, VAT**, taxes applied to the generation of PV energy.

**Ratio of equivalent CO2 emissions:**
Sets the ratio of equivalent CO$_2$ for 1 kWh, according to the energy mix of each country.
6.3.- STRING MONITORING SCREEN

The screen shown in Figure 26 displays the status of fuses and photovoltaic strings, indicating the values of the current they are generating.

A blown fuse is shown in red on the screen.
6.4.- CONFIGURATION OF ALARMS

To access the configuration of alarms and notifications of alarms sent via e-mail, access the web site of the PV-Monitor through port 8082.
From a web browser, by entering this address: 192.168.0.2:8082 (with the computer connected to the router)

![E-mail setup screen](image)

6.4.1. CONFIGURATION OF THE ALARM WARNINGS SENT VIA E-MAIL

Open the Settings tab to configure the notifications of alarms sent via e-mail.
You can configure the following parameters on this screen:

**SMTP server configuration:**
The operator of the e-mail server is entered in this section.

**Mail address**
The e-mail address at which you wish to receive the notifications.

**Password, Password confirmation**
The password of the e-mail account.

Press the Apply button to save the configuration.
6.4.2. CONFIGURATION OF ALARMS

The alarms of the **PV-Monitor** are deactivated by default. They can be activated via the **Events** tab in **Figure 27**.

The **Events** tab is shown in **Figure 28**.

![Figure 28: Alarm setup screen.](image)

To activate an alarm, click on the 🔊 button. The screen shown in **Figure 29** will open.

![Figure 29: Configuration of the alarms, entering the e-mail address.](image)

Enter the e-mail address at which you wish to receive the alarm notification and press **Add**. Press **Accept** to complete the configuration process.
## 7.- TECHNICAL FEATURES

### Power supply
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>85 ... 264 V ~ / 120 ... 374 V</td>
</tr>
<tr>
<td>Frequency</td>
<td>47 ... 63 Hz</td>
</tr>
<tr>
<td>Maximum consumption</td>
<td>5 ... 8 VA</td>
</tr>
<tr>
<td>Installation category</td>
<td>CAT III 300 V</td>
</tr>
</tbody>
</table>

### Relay outputs
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>6</td>
</tr>
<tr>
<td>Maximum voltage, open contacts</td>
<td>250 V~</td>
</tr>
<tr>
<td>Maximum current</td>
<td>5 A</td>
</tr>
<tr>
<td>Maximum switching power</td>
<td>740 VA</td>
</tr>
<tr>
<td>Electrical working life (250 V~ / 5A)</td>
<td>3 x 10^4 cycles</td>
</tr>
<tr>
<td>Mechanical working life</td>
<td>2 x 10^7 cycles</td>
</tr>
</tbody>
</table>

### Digital inputs
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>8</td>
</tr>
<tr>
<td>Type</td>
<td>Optoisolated voltage-free</td>
</tr>
<tr>
<td>Maximum activation current</td>
<td>50 mA</td>
</tr>
<tr>
<td>Insulation</td>
<td>1500 V</td>
</tr>
</tbody>
</table>

### Network interface
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Ethernet 10BaseTX</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ-45</td>
</tr>
<tr>
<td>Network protocol</td>
<td>HTTP / Modbus/RTU</td>
</tr>
</tbody>
</table>

### Serial interface (PV-Monitor-M)
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>RS-485</td>
</tr>
<tr>
<td>Speed</td>
<td>4800 - 9600 - 19200 - 34800 - 57600 - 115200 bps</td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Parity</td>
<td>none - even - odd</td>
</tr>
</tbody>
</table>

### Server
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server</td>
<td>Built-in Web and XML server</td>
</tr>
</tbody>
</table>

### User interface
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEDs</td>
<td>2</td>
</tr>
<tr>
<td>Keys</td>
<td>4</td>
</tr>
<tr>
<td>Display</td>
<td>Backlit LCD</td>
</tr>
</tbody>
</table>

### Environmental features
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-10°C ... +60°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20°C ... + 65°C</td>
</tr>
<tr>
<td>Relative humidity (with no condensation)</td>
<td>5 ... 95%</td>
</tr>
<tr>
<td>Maximum altitude</td>
<td>2000 m</td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP51</td>
</tr>
</tbody>
</table>

### Mechanical features
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (mm)</td>
<td>Figure 30</td>
</tr>
<tr>
<td>Weight</td>
<td>280 g</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Self-extinguishing V0 plastic, UL94</td>
</tr>
</tbody>
</table>
Figure 30: Dimensions of the PV-Monitor

<table>
<thead>
<tr>
<th>Standards</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordination of the insulation of units installed in low voltage systems (networks). Part 1: Principles, requirements and tests.</td>
<td>UNE-EN 60664-1:2008</td>
</tr>
<tr>
<td>Insulation coordination for electrical equipment within low-voltage systems</td>
<td>DIN VDE 0110</td>
</tr>
<tr>
<td>Safety requirements for electrical devices for measurement, control and laboratory use. Part 1: General requirements.</td>
<td>UNE-EN 61010-1:2011</td>
</tr>
</tbody>
</table>
8.- MAINTENANCE AND TECHNICAL SERVICE

In the case of any query in relation to unit operation or malfunction, please contact the CIRCUTOR, SA Technical Support Service.

Technical Assistance Service
Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)
Tel: 902 449 459 (España) / +34 937 452 919 (outside of Spain)
email: sat@circutor.com

9.- GUARANTEE

CIRCUTOR guarantees its products against any manufacturing defect for two years after the delivery of the units.

CIRCUTOR will repair or replace any defective factory product returned during the guarantee period.

- No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
- The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. “Improper usage” is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual.
- CIRCUTOR accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or “improper usage” of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:
  - Overvoltages and/or electrical disturbances in the supply;
  - Water, if the product does not have the appropriate IP classification;
  - Poor ventilation and/or excessive temperatures;
  - Improper installation and/or lack of maintenance;
  - Buyer repairs or modifications without the manufacturer’s authorisation.
10.- CE CERTIFICATE